Claims

1. A lithography system comprising:

a plurality of lens elements;

the plurality of lens elements having a first lens element adapted to face a source of radiation, and having a final lens element comprising a material with an index of refraction greater than 1, and having a surface adapted to be pressed against the sample in order to form a depression at the surface of the sample facing the final lens element; and

a stage to support said sample in contact with the surface of the final lens element.

2. The lithography system of claim 1, wherein the material of said final lens element comprises one of silicon dioxide, calcium fluoride, aluminum oxide, yttrium fluoride, lanthanum fluoride, strontium fluoride.

3. The lithography system of claim 1, wherein said plurality of lens elements projects radiation having a wavelength of about 193nm to the sample.

4. The lithography system of claim 1, wherein said plurality of lens elements projects radiation having a wavelength of about 157nm to the sample.

5. The lithography system of claim 1, including a mask between the source of radiation and said plurality of lens elements, and said plurality of lens elements demagnifies an object on the mask by a factor greater than 4 at an image plane on or near said sample.

6. The lithography system of claim 1, including a mask between the source of radiation and said plurality of lens elements, and said plurality of lens elements projects an image of an object on the mask at an image plane on or near the surface of the final lens.

7. The lithography system of claim 1, wherein said sample has a layer adapted to be developed in response to radiation projected by the plurality of lens elements.

8. The lithography system of claim 7, wherein said sample has a soft layer coated on top of said layer adapted to be developed in response to radiation projected by the plurality of lens elements.

9. The lithography system of claim 1, wherein a material adapted to be developed in response to radiation projected by the plurality of lens elements is dispensed on top of the sample before the final lens element is pressed against the sample.

10. The lithography system of claim 1, wherein the final lens element comprises a removable slab of said material.

11. A lithography system comprising:

a projection lens for imaging an object on a mask onto a sample, one side of the projection lens adapted to be pressed against the sample in order to form a depression at the surface of the sample facing the projection lens and an other side of the projection lens adapted to be placed in contact or in close proximity with the mask; and

a stage to support said sample in contact with the projection lens.

12. The lithography system of claim 11, wherein the other side of the projection lens placed in contact or in close proximity with the mask comprises a removable slab of material.

13. The lithography system of claim 11, wherein a material of a lens element of said projection lens adapted to be placed in contact or in close proximity with the mask, comprises a material including one of silicon dioxide, calcium fluoride, aluminum oxide, yttrium fluoride, lanthanum fluoride, strontium fluoride.

14. The lithography system of claim 11, wherein said projection lens projects radiation having a wavelength of about 193nm from the mask to the sample.

15. The lithography system of claim 11, wherein said projection lens projects radiation having a wavelength of about 157nm from the mask to the sample.

16. The lithography system of claim 11, wherein said projection lens demagnifies an image on the mask by a factor greater than 4 at an image plane on or near said sample.

17. The lithography system of claim 11, wherein said projection lens, includes a lens element having a surface adapted to be pressed against the sample in order to form a depression at the surface of the sample facing the lens element, and the projection lens projects an image of a mask at an image plane on or near said surface of said lens element.

18. The lithography system of claim 11, wherein said projection lens, includes a lens element having a surface adapted to be pressed against the sample in order to form a depression at the surface of the sample facing the lens, said lens element comprises a removable slab.

19. A method for manufacturing integrated circuits, comprising:

providing a sample having a layer adapted to be developed in response to radiation;

providing a layout object to be projected on said layer;

pressing said layer on said sample against a lens element of a projection lens in order to form a depression at the surface of the layer facing the lens element, wherein said lens element comprises a material having an index of refraction for said radiation greater than 1; and

imaging the object on said layer through said projection lens.

20. The method of claim 19, including imaging the object at an image plane near a top surface of said layer.

21. The method of claim 19, where a soft layer is coated on top of said layer adapted to be developed in response to radiation.

22. The method of claim 19, including preventing adhesion of said lens element to said layer.

23. The method of claim 19, including cleaning the lens element after exposure.

24. The method of claim 19, including placing a mask including said layout object in contact or close proximity with another lens element of a projection lens, wherein said other lens element comprises a material having an index of refraction for said radiation greater than 1.

25. The method of claim 19, including laying out a layout pattern on a mask including the layout object to be imaged on said layer, said laying out including applying proximity correction using a lithography model comprising, for an incident material different than air characterized by its refractive index and absorption coefficient, calculating fields in said layer, accounting for the incident material refractive index and absorption coefficient, performed using thin film optics or by solving Maxwell equations

26. The method of claim 19, including laying out a layout pattern on a mask including the layout object to be imaged on said layer, the layout pattern comprising an alternating aperture phase-shifting mask layout, said laying out including applying proximity correction using a lithography model comprising, for an incident material different than air characterized by its refractive index and absorption coefficient, calculating fields in said layer, accounting for the incident material refractive index and absorption coefficient, performed using thin film optics or by solving Maxwell equations.

27. The method of claim 19, including laying out a layout pattern on a mask including the layout object to be imaged on said layer, wherein said imaging the object on said layer through said projection lens, includes applying an off-axis setting for the projection lens, the off-axis setting obtained using a lithography model comprising, for an incident material different than air characterized by its refractive index and absorption coefficient, calculating fields in the resist, accounting for the incident material refractive index and absorption coefficient, performed using thin film optics or by solving Maxwell equations.

28. The method of claim 19, including laying out a layout pattern on a mask including the layout object to be imaged on said layer, the layout pattern comprising an assist feature having a size and a distance from a corresponding main feature, said laying out including determining said size and distance using a lithography model comprising, for an incident material different than air characterized by its refractive index and absorption coefficient, calculating fields in said layer, accounting for the incident material refractive index and absorption coefficient, performed using thin film optics or by solving Maxwell equations.

29. The method of claim 19, including laying out a layout pattern on a mask including the layout object to be imaged on said layer, the layout pattern comprising an attenuated phase-shifting mask having sizing parameters, said laying out including determining said sizing parameters using a lithography model comprising, for an incident material different than air characterized by its refractive index and absorption coefficient, calculating fields in said layer, accounting for the incident material refractive index and absorption coefficient, performed using thin film optics or by solving Maxwell equations.

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30. The method of claim 19, wherein the sample comprises a wafer including a plurality of materials forming a wafer stack, and including laying out a layout pattern on a mask including the layout object to be imaged on said layer, said laying out including applying proximity correction using a lithography model comprising, for an incident material different than air characterized by its refractive index and absorption coefficient, dividing the refractive indices and absorption coefficients of all the materials in the wafer stack by the refractive index of the incident material.